

ON

ATMOSPHERIC CONDITIONS

INFLUENCING THE PREVALENCE OF

TYPHUS FEVER.

BY

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PREVALENCE OF TYPHUS FEVER.

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THE frequency with which typhus fever has prevailed of late, and unfortunately still prevails in Dublin, together with the well-marked character and violence of the disease, as now seen in our hospitals, affords rare opportunity for the study of this formidable disease. I do not propose to discuss the cause of typhus, whether contagion is necessary to its commencement, or whether it may arise, *de novo*, in a locality into which the seeds of contagion have not been imported, but to consider some of those causes which are favourable to its spread (and, of course, *vice versa*), and which are therefore likely to assist its origin, if it do originate, *de novo*, in a locality.

It must have been observed by all those attached to fever hospitals, and by those familiar with typhus, that at all times, and especially during an epidemic, sudden rises take place in the number of patients attacked. This is especially remarkable in hospitals, where at one time we find ourselves quickly reducing the number of occupied beds, while in the succeeding week or ten days we shall find ourselves compelled, as rapidly, if not more rapidly, to increase our hospital accommodation. On becoming attached to the Cork-street Fever Hospital, these sudden rises and falls in the rate of admissions at once attracted my attention, as worthy of inquiry as to their cause. On discussing the question with my friend and

senior colleague, Dr. Kennedy, we came to the conclusion, that a sudden increase of moisture in the atmosphere, more especially when in conjunction with an increase in temperature, was always followed by sudden pressure on the hospital accommodation.

Dr. O'Brien (in his report of the House of Recovery and Fever Hospital, Cork-street, for the year ending January 4th, 1827, published in the *Transactions* of this society for 1828), when speaking of the atmospheric influences which act as exciting causes of fever, seems to hold similar opinions to those which I have just advanced—namely, that heat and exhalations from the ground (which are nearly all accompanied by moisture) are the chief exciting causes of fever. When treating of the causes of fever in general, having enumerated the conditions consequent on poverty, he goes on to state “that these causes alone are insufficient for the creation of such calamities, without the aid of those we call exciting causes, the most powerful of which are—extremes of heat and cold, human contagion, and malaria, or morbid exhalations from the earth, diffused through atmosphere.” Further on in the report from which I am quoting, the author gives an example of how a certain condition of temperature and humidity combining may produce fever of the ephemeral class. This case, although not one of typhus, shows that this accurate observer had noticed similar exciting causes of fever to those which have been noticed by Dr. Kennedy and myself. If the case reported had been one of typhus, perhaps Dr. O'Brien would have found that, not moisture and cold, but moisture and heat were the exciting causes of the disease. It is also to be remarked that in the table of admissions into Cork-street Hospital, given in Dr. O'Brien's report, the greatest increase in admissions did not occur until the wet, or rather, variable weather commenced—namely, after the 15th of July, 1826, on which day rain fell for the first time for four months.

This opinion (of my colleague and myself) however, was founded on frequent but not very accurately-tested observation. I at once determined accurately to test the truth of our opinion by a series of minute observations, and the chief object of this paper is to bring the result of these observations under notice.

I am aware that attempts have been made to compare increase and decrease of fever with the conditions of the atmosphere, but these observations have all, as far as I can ascertain, been confined to the taking of averages for considerable periods; for instance, we read of typhus epidemics being at their height in Winter, and therefore it is

concluded that the prevalence of that form of fever is favoured by cold. Again, we read of great increase of fever in the Summer and Autumn months, and some therefore infer that warm weather assists in the spread of typhus. Other writers, for instance Dr. Murchison, in his valuable and elaborate work *On the Continued Fevers of Great Britain*, very fairly concludes from those contradictory statements, that "ordinary variations in temperature have little influence over the prevalence of typhus," and says "the hygrometric states of the atmosphere have no effect on the prevalence of typhus." He seems, however, to think that cold has, indirectly, by keeping the poor more at home, and consequently causing overcrowding in their houses, which are usually destitute of ventilation—a powerful influence in increasing the prevalence of typhus. I do not altogether agree with Dr. Murchison in laying so much stress on overcrowding, as any other effect of poverty, hunger, or dirt, might as well be taken as *the* cause, although, perhaps, overcrowding is *one* of the more potent causes of typhus.

It is not sufficient to take averages of months and seasons in order fairly to conduct enquiries of this sort, and draw accurate conclusions, from results thus obtained. For accurate conclusions minute observations are absolutely necessary.

In order to follow up this enquiry, I took the daily number of admissions into Cork-street Hospital during 1864, from localities situated in the south side of the city, distinguishing, during the last seven months of that year, the purely typhus cases from all others. Having tabulated these numbers, I constructed from these tables diagrams representing the prevalence of zymotic disease during the whole of the year 1864, and of typhus during the latter seven months of the same year.^a

I took the precaution of ascertaining that the rises of fever admissions in other hospitals of the city corresponded with those in Cork-street, so that the curves in the diagrams may fairly be taken to represent the variations in the prevalence of these diseases in the whole city, during the year 1864. The reasons for selecting 1864 in preference to the past year (1865) for demonstrating these observations are, that at the commencement of that year it could scarcely be said there was an epidemic in this city, while, at the end of the year the epidemic had risen almost to its greatest height.

^a The diagrams were exhibited to the meeting before which this paper was read. The lower continuous line of the plate is a representation of the curve of the typhus diagram mentioned above.

The reasons for selecting the seven months, from the end of May to the end of December, 1864, are of similar nature, with this addition, that previous to May the records were deficient, owing to changes in the hospital staff and management. But to ascertain the causes affecting the variations in the fever line of the diagrams, it was necessary first to ascertain how far back I should look for those causes, in other words, to ascertain how long ill the patients had been before admission. To do this accurately was almost impossible; but taking the patient's own statements, and making all due allowance, I found the average to be five days; and as patients usually underrate the duration of their disease, determined that I was to look back from five to six days for the causes for which I was searching. For comparison with the diagram of the rise and fall of typhus, I constructed diagrams illustrating the rise and fall of the moisture, of the minimum, maximum, and mean temperature^a of the atmosphere, for the seven months ending Dec. 31st, 1864.

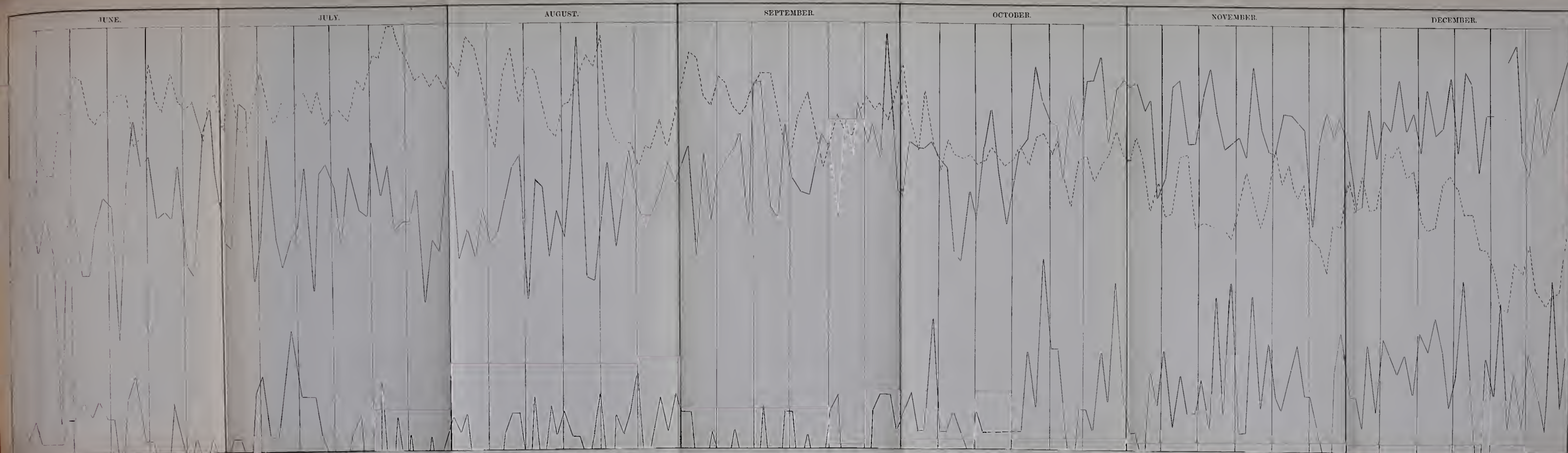
I found that it was unnecessary to consider the direction of the wind, the height of the barometer, or the rainfall, as these were causes producing the variations in the former set of conditions mentioned.^b

The diagrams of atmospheric conditions thus constructed I placed in juxtaposition with that representing the prevalence of fever, placing them so that each day of the fever diagram would correspond with the meteorological conditions existing five days previous—in other words, placing the effect under the supposed causes. These I have so arranged, that they can be conveniently compared with each other.^c—See plate.

^a The dotted line in the plate represents the variations in mean temperature, the upper continuous line the variations in moisture. It was considered better not to place all the curves mentioned above, in the plate, as only likely to cause confusion. The vertical lines in the plate are drawn at intervals of five days.

^b At the conclusion of the reading of this paper before the Association of the College of Physicians, Dr. Lyons suggested to the author the propriety of adding a line to his diagrams, representing the variations of the amount of ozone in the atmosphere. To do this with regard to the present series of observations was impossible, as the author had no table of ozonometric observations to refer to corresponding with the period over which his observations extended. The author has since investigated this interesting subject, and hopes soon to bring his observations before the public. In the meantime he may state that there seems to be little relation between the amount of ozone in the atmosphere and the prevalence of typhus fever.

^c A tracing combining the curves of these diagrams on one sheet, placed on a perpendicular board, with a plumb line attached, so that all could be compared at once, was exhibited at the time this paper was read.



The dotted line represents the rise and fall of mean Temperature. the upper continuous line the rise and fall of moisture in the Atmosphere. the lower continuous line the rise and fall of Typhus Fever, from May 29th to December 31st 1861.

The following slight errors occur in the diagrams:—

Sundays and Mondays cause an inequality in the rate of admissions, being usually less on Sunday than on any other day during the week, and consequently more on Monday; also the month of September is incorrect, as only about half the admissions from the 3rd of that month to the 3rd of October are represented; this, however, does not influence the *relations* of the rise and fall of the line to the conditions of the atmosphere. I thought it better to leave the error as it is, mentioning it, than attempt a theoretical correction. Before carefully comparing the diagrams when finished, I felt so convinced that the moisture was the great influencing cause, that I tested my opinion by giving the fever diagram to a friend, and taking the moisture diagram myself. In taking sixteen instances at random, I stated what variations should be found by my friend in the fever diagram, and in all those instances I proved correct. What conclusions may we draw from the inspection of these diagrams?

1st. That an increase in the moisture of the atmosphere favours an increase in typhus, and *vice versa*.

2nd. That an increase of temperature favours an increase of typhus, and *vice versa*.

3rd. That the two previous conditions combined are *most* favourable to an increase in typhus, and *vice versa*.

5th. That when cold and moisture combine, the former tends to diminish the influence of the latter.

It will thus be seen that an increase of moisture, other things being equal, is the atmospheric change most favourable to an increase of typhus; but that when to this is added an increase of temperature, we have *the* most favourable atmospheric conditions for the spread of fever. It would also appear that dryness and cold (the latter particularly) have an influence contrary to the spread of fever. I do not mean to state that there are no exceptions to the rules just laid down, but the exceptions, which are few, and by no means well marked, are easily accounted for by other disturbing causes.

Since the greater portion of this paper was written, I have had *three* opportunities of verifying, in a remarkable degree, that an increase of moisture in the atmosphere, with a rise in temperature, is very favourable to an increase in fever; namely—

On December the 7th, 1865, an increase of moisture and temperature, which was observed and noted at the time, was followed by

an increased number of admissions into Cork-street Hospital. On the 12th and 13th of that month the number of patients admitted was eighteen; the average for that year being six per day.

On Christmas-day, 1865 (the peculiar atmospheric conditions of which must be remembered by all), I took another note to the effect that there should, in consequence of the unusual dampness and heat of that day, be a pressure on the hospital accommodation on January 1st, 1866; this proved to be the case.

The last instance, however, is the most remarkable. On January 5th the hydrometric condition was unusually high (reported 0·9 at the Ordnance Survey Department); the temperature also was rather high during the day, but not very remarkably so. I foretold a great rise in the hospital admissions on the 10th and 11th, which took place—21 patients being admitted on those two days, with a few on the morning of 12th, altogether more than I have known to be admitted in the same short period since my observations commenced, the rate of admission on the 11th, being the highest but one of which I have taken particular note, although I think there may be a few as high.

I have foretold a rise in the rate of hospital admissions on the 18th of this month (January), in consequence of observations taken on the 13th of January (the day following the late frost). I should like the gentlemen present, connected with fever hospitals, to observe if this forecast proves correct.^a

I think these observations of some practical value, as all cause favouring the spread, must necessarily favour the origin of disease.

^a This forecast *did* prove correct, a large increase in hospital admissions taking place on the 18th and 19th of January, 1866.